Projected employment growth varies by occupation. Employment of central office and PBX installers and repairers is expected to grow faster than average, as the growing popularity of the Internet continues to place new demand on telecommunications networks. Conventional switches designed to handle voice communications will need to be replaced and upgraded with equipment that can communicate more complex information, such as data, videos, and graphics. Switches that can quickly relay both voice and data communications will become a necessity. Whereas increased reliability and automation of switching equipment will constrain employment growth, these effects will be offset by the strong demand for installation and upgrading of switching equipment.

Despite some demand for mechanics in the rapidly growing wireless telecommunication sector to build networks of receivers, transmitters, and other equipment, the employment of radio mechanics is projected to decline. The replacement of two-way radio systems by wireless systems, especially in service vehicles, has eliminated the need in many companies for on-site radio mechanics. The increased reliability of wireless equipment and the use of self-monitoring systems will continue to lessen this need.

Employment of station installers and repairers is also expected to decline. Pre-wired buildings and the increasing reliability of telephone equipment will decrease the need for installation and maintenance of customers' telephones. The popularity of the Internet may increase employment over the next few years, as additional households request the installation of second telephone lines. However, this should be offset by the deployment of new technologies, such as digital subscriber lines, which allow simultaneous voice and data communications, and wireless telecommunications services, which do not require installation.

Earnings

In 1998, median hourly earnings of central office and PBX installers and repairers were $21.00. The middle 50 percent earned between $18.09 and $23.52. The bottom 10 percent earned less than $13.92, whereas the top 10 percent earned more than $25.79. Median hourly earnings in the telephone communications industry were $20.40 in 1997.

Median hourly earnings of radio mechanics in 1998 were $14.71. The middle 50 percent earned between $11.21 and $18.73. The bottom 10 percent earned less than $9.09, whereas the top 10 percent earned more than $23.21.

Median hourly earnings of station installers and repairers in 1998 were $19.06. The middle 50 percent earned between $15.80 and $22.17. The bottom 10 percent earned less than $11.55, whereas the top 10 percent earned more than $24.07. Median hourly earnings were $18.90 in the telephone communications industry in 1997.

Central office installers, central office technicians, PBX installers, and telephone installers and repairers represented by the Communications Workers of America earned between $283 and $996 a week in 1998.

Telephone installers and repairers, represented by the International Brotherhood of Electrical Workers, earned between $12.60 and $22.50 an hour in 1999. Equipment installer technicians represented by the same union earned between $16.70 and $24.80 an hour in 1999.

Related Occupations

Related occupations that work with electronic equipment include broadcast and sound technicians; computer, automated teller, and office machine repairers; electronic home entertainment equipment repairers; and electronics repairers, commercial and industrial equipment. Electronics engineering technicians may also repair electronic equipment, as part of their duties.

Sources of Additional Information

For information on career opportunities, contact:

☛ International Brotherhood of Electrical Workers, Telecommunications Department, 1125 15th St. NW., Room 807, Washington, DC 20005.

☛ Communications Workers of America, 501 3rd St. NW., Washington, DC 20001. Internet: **http://www.cwa-union.org**

For information on the telephone communications industry, contact:

☛ United States Telephone Association, 1401 H St. NW., Suite 600, Washington, DC 20005-2164. Internet: **http://www.usta.org**

Other Mechanics, Installers, and Repairers

Aircraft Mechanics and Service Technicians

(O*NET 85323A, 85323B, 85326, and 85728A)

Significant Points

- The vast majority learn their job in 1 of about 200 trade schools certified by the Federal Aviation Administration.
- On the whole, opportunities should be favorable, but keen competition is likely for the best paying jobs with airlines.

Nature of the Work

To keep aircraft in peak operating condition, aircraft mechanics and service technicians perform scheduled maintenance, make repairs, and complete inspections required by the Federal Aviation Administration (FAA).

Many aircraft mechanics specialize in preventive maintenance. They inspect engines, landing gear, instruments, pressurized sections, accessories—brakes, valves, pumps, and air-conditioning systems, for example—and other parts of the aircraft and do the necessary maintenance and replacement of parts. Inspections take place following a schedule based on the number of hours the aircraft has flown, calendar days, cycles of operation, or a combination of these factors. To examine an engine, aircraft mechanics work through specially designed openings while standing on ladders or scaffolds, or use hoists or lifts to remove the entire engine from the craft. After taking an engine apart, mechanics use precision instruments to measure parts for wear and use x-ray and magnetic inspection equipment to check for invisible cracks. Worn or defective parts are repaired or replaced. They may also repair sheet metal or composite surfaces, measure the tension of control cables, and check for corrosion, distortion, and cracks in the fuselage, wings, and tail. After completing all repairs, mechanics must test the equipment to ensure that it works properly.

Mechanics specializing in repair work rely on the pilot's description of a problem to find and fix faulty equipment. For example, during a preflight check, a pilot may discover that the aircraft's fuel gauge does not work. To solve the problem, mechanics may troubleshoot the electrical system, using electrical test equipment to make sure no wires are broken or shorted out and replace any defective electrical or electronic components. Mechanics work as fast as safety permits, so the aircraft can be put back into service quickly.

Large, sophisticated planes are equipped with aircraft monitoring systems, consisting of electronic boxes and consoles that monitor the aircraft's basic operations and provide valuable diagnostic information to the mechanic.

Some mechanics work on one or many different types of aircraft, such as jets, propeller-driven airplanes, and helicopters. Others specialize in one section of a particular type of aircraft, such as the engine, hydraulics, or electrical system. *Powerplant mechanics* are

Aircraft mechanics inspect aircraft on a scheduled basis.

authorized to work on engines and do limited work on propellers. *Airframe mechanics* are authorized to work on any part of the aircraft except the instruments, powerplants, and propellers. *Combination airframe-and-powerplant mechanics*—called A & P mechanics—work on all parts of the plane, except instruments. The majority of mechanics working on civilian aircraft today are A & P mechanics. In small, independent repair shops, mechanics usually inspect and repair many different types of aircraft.

Avionics systems are now an integral part of aircraft design and have vastly increased aircraft capability. *Avionics technicians* repair and maintain components used for aircraft navigation and radio communications, weather radar systems, and other instruments and computers that control flight, engine, and other primary functions. These duties may require additional licenses, such as an FCC radiotelephone license. Because of technological advances, an increasing amount of time is spent repairing electronic systems, such as computerized controls. Technicians may also be required to analyze and develop solutions to complex electronic problems.

Working Conditions

Mechanics usually work in hangars or in other indoor areas, although they can work outdoors—sometimes in unpleasant weather—when hangars are full or when repairs must be made quickly. Mechanics often work under time pressure to maintain flight schedules or, in general aviation, to keep from inconveniencing customers. At the same time, mechanics have a tremendous responsibility to maintain safety standards, and this can cause the job to be stressful.

Frequently, mechanics must lift or pull objects weighing as much as 70 pounds. They often stand, lie, or kneel in awkward positions and occasionally must work in precarious positions on scaffolds or ladders. Also, noise and vibration are common when testing engines. Aircraft mechanics usually work 40 hours a week on 8-hour shifts around the clock. Overtime work is frequent.

Employment

Aircraft mechanics and service technicians held about 133,000 jobs in 1998. About two-thirds of all salaried mechanics worked for airlines or airports and flying fields, about 1 out of 8 worked for the Federal Government, and about 1 out of 7 worked for aircraft assembly firms. Most of the rest were general aviation mechanics, the majority of whom worked for independent repair shops or companies that operate their own planes to transport executives and cargo. Few mechanics were self-employed.

Most airline mechanics work at major airports near large cities. Civilian mechanics employed by the Armed Forces work at military installations. Large proportions of mechanics who work for aircraft assembly firms are located in California or Washington State. Others work for the FAA, many at the facilities in Oklahoma City, Atlantic City, or Washington, DC. Mechanics for independent repair shops work at airports in every part of the country.

Training, Other Qualifications, and Advancement

The majority of mechanics who work on civilian aircraft are certificated by the FAA as "airframe mechanic," "powerplant mechanic," or "avionics repair specialist." Mechanics who also have an inspector's authorization can certify work completed by other mechanics and perform required inspections. Uncertificated mechanics are supervised by those with certificates.

The FAA requires at least 18 months of work experience for an airframe, powerplant, or avionics repairer's certificate. For a combined A & P certificate, at least 30 months of experience working with both engines and airframes is required. Completion of a program at an FAA certificated mechanic school can substitute for the work experience requirement. Applicants for all certificates also must pass written and oral tests and demonstrate that they can do the work authorized by the certificate. To obtain an inspector's authorization, a mechanic must have held an A & P certificate for at least 3 years. Most airlines require that mechanics have a high school diploma and an A & P certificate.

Although a few people become mechanics through on-the-job training, most learn their job in one of about 200 trade schools certified by the FAA. About one-third of these schools award 2- and 4-year degrees in avionics, aviation technology, or aviation maintenance management.

FAA standards established by law require that certificated mechanic schools offer students a minimum of 1,900 actual class hours. Courses in these trade schools normally last from 24 to 30 months and provide training with the tools and equipment used on the job. Aircraft trade schools are placing more emphasis on technologies such as turbine engines, composite materials—including graphite, fiberglass, and boron—and aviation electronics, which are increasingly being used in the construction of new aircraft. Less emphasis is being placed on old technologies, such as woodworking and welding. Additionally, employers prefer mechanics who can perform a variety of tasks.

Some aircraft mechanics in the Armed Forces acquire enough general experience to satisfy the work experience requirements for the FAA certificate. With additional study, they may pass the certifying exam. In general, however, jobs in the military services are too specialized to provide the broad experience required by the FAA. Most Armed Forces mechanics have to complete the entire training program at a trade school, although a few receive some credit for the material they learned in the service. In any case, military experience is a great advantage when seeking employment; employers consider trade school graduates who have this experience to be the most desirable applicants.

Courses in mathematics, physics, chemistry, electronics, computer science, and mechanical drawing are helpful, because many of

their principles are involved in the operation of aircraft and knowledge of these principles is often necessary to make repairs. Courses that develop writing skills are also important, because mechanics are often required to submit reports.

FAA regulations require current experience to keep the A & P certificate valid. Applicants must have at least 1,000 hours work experience in the previous 24 months or take a refresher course. As new and more complex aircraft are designed, more employers are requiring mechanics to take on-going training, to update their skills. Recent technological advances in aircraft maintenance necessitate a strong background in electronics—both for acquiring and retaining jobs in this field. FAA certification standards also make ongoing training mandatory. Every 24 months, mechanics are required to take at least 16 hours of training to keep their certificate. Many mechanics take courses offered by manufacturers or employers, usually through outside contractors.

Aircraft mechanics must do careful and thorough work that requires a high degree of mechanical aptitude. Employers seek applicants who are self-motivated, hard-working, enthusiastic, and able to diagnose and solve complex mechanical problems. Agility is important for the reaching and climbing necessary for the job. Because they may work on the top of wings and fuselages on large jet planes, aircraft mechanics must not be afraid of heights.

As aircraft mechanics gain experience, they may advance to lead mechanic (or crew chief), inspector, lead inspector, or shop supervisor positions. Opportunities are best for those who have an aircraft inspector's authorization. In the airlines, where promotion is often determined by examination, supervisors sometimes advance to executive positions. Those with broad experience in maintenance and overhaul might become inspectors with the FAA. With additional business and management training, some open their own aircraft maintenance facilities. Mechanics learn many different skills in their training that can be applied to other jobs, and some transfer to other skilled repairer occupations or electronics technician jobs.

Job Outlook

The outlook for aircraft mechanics should be favorable over the next 10 years. The small numbers of young workers in the labor force, coupled with few entrants from the military, and a large number of retirements point to good employment conditions for students just beginning training.

Job opportunities are likely to be the best at small commuter and regional airlines, FAA repair stations, and in general aviation. Because wages in these companies tend to be relatively low, there are fewer applicants for these jobs than for jobs with the major airlines. Also, some jobs will become available as experienced mechanics leave for higher paying jobs with airlines or transfer to another occupation. Mechanics will face competition for large airline jobs, because the high wages and travel benefits for these jobs attract more qualified applicants than there are openings. Prospects will be best for applicants with significant experience. Mechanics who keep abreast of technological advances in electronics, composite materials, and other areas will be in greatest demand. The number of job openings for aircraft mechanics in the Federal Government should decline, as the size of the Armed Forces is reduced.

Employment of aircraft mechanics is expected to increase about as fast as the average for all occupations through the year 2008. A growing population and rising incomes are expected to stimulate the demand for airline transportation, and the number of aircraft is expected to grow. However, employment growth will be restricted somewhat by increases in productivity, resulting from greater use of automated inventory control and modular systems that speed repairs and parts replacement.

Most job openings for aircraft mechanics through the year 2008 will stem from replacement needs. Each year, as mechanics transfer to other occupations or retire, several thousand job openings will arise. Aircraft mechanics have a comparatively strong attachment to the occupation, reflecting their significant investment in training and a love for aviation. However, because aircraft mechanics' skills are transferable to other occupations, some mechanics leave for work in related fields.

During recessions, declines in air travel force airlines to curtail the number of flights, which result in less aircraft maintenance and, consequently, layoffs for aircraft mechanics.

Earnings

Median hourly earnings of aircraft mechanics and service technicians were about $18.30 in 1998. The middle 50 percent earned between $14.91 and $22.12. The lowest 10 percent earned less than $11.92 and the highest 10 percent earned more than $24.40. Median hourly earnings in the industries employing the largest number of aircraft mechanics and service technicians in 1997 were:

Air transportation, scheduled	$20.80
Federal government	17.40
Air transportation, nonscheduled	15.40
Aircraft and parts	15.20
Airports, flying fields, and services	14.60

Mechanics who work on jets for the major airlines generally earn more than those working on other aircraft. Airline mechanics and their immediate families receive reduced fare transportation on their own and most other airlines.

Almost one-half of all aircraft mechanics, including those employed by some major airlines, are covered by union agreements. The principal unions are the International Association of Machinists and Aerospace Workers and the Transport Workers Union of America. Some mechanics are represented by the International Brotherhood of Teamsters.

Related Occupations

Workers in some other occupations that involve similar mechanical and electrical work are electricians, electronic equipment repairers, and elevator repairers.

Sources of Additional Information

Information about jobs in a particular airline can be obtained by writing to the personnel manager of the company. For general information about aircraft mechanics, write to:

☛ Professional Aviation Maintenance Association, 636 I St. NW., Suite 300, Washington, DC 20001.

For information on jobs in a particular area, contact employers at local airports or local offices of the State employment service.

Automotive Body Repairers

(O*NET 85305A, 85305B, and 85305C)

Significant Points

- Many still learn this trade on the job as helpers, although employers prefer to hire persons with automotive body repair training.
- Good reading and basic mathematics skills are needed to follow instructions and diagrams in technical manuals.

Nature of the Work

Thousands of motor vehicles are damaged in traffic accidents every day. Although some of these vehicles are sold for salvage or scrapped, most can be repaired to look and drive like new. Automotive body repairers straighten bent bodies, remove dents, and replace crumpled parts that are beyond repair. They repair all types of vehicles but mostly work on cars and small trucks, although some work on large trucks, buses, or tractor-trailers.

When a damaged vehicle is brought into the shop, body repairers generally receive instructions from a supervisor who determines which parts to restore or replace and how much time the job should take.